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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : G06F 13/00 | A1

(11) International Publication Number: WO 97/32256

(43) International Publication Date: 4 September 1997 (04.09.97)

(21) International Application Number: PCT/US97/03099

(22) International Filing Date: 28 February 1997 (28.02.97)

(30) Priority Data:
609,025 29 February 1996 (29.02.96) US

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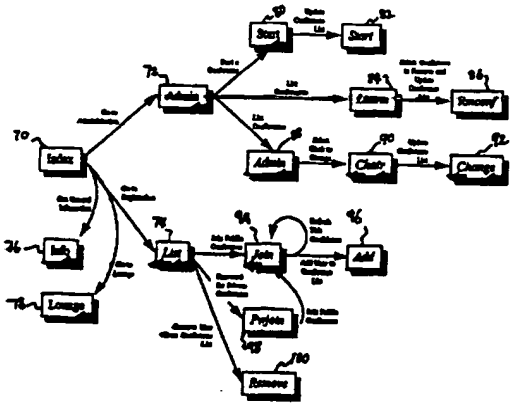
(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, UZ, VN, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: METHOD FOR CREATING PEER-TO-PEER CONNECTIONS OVER AN INTERCONNECTED NETWORK TO FACILITATE CONFERENCING AMONG USERS



(57) Abstract

A method for facilitating the creation and participation of on-line conferences in accordance to the peer-to-peer paradigm is disclosed. A designated location on the network (e.g., a web site 56) such as Internet is set up so that a conference (94) may be created and conference participants (98) can be easily connected into the conference. The IP addresses of the conference participants (98) are maintained at the designated site and are transmitted to a new conference participant (98) to allow the new conference participant to connect directly into the conference without the new participant (98) having to know the IP addresses of the conference participants (98). The new participant may be connected to any one of the existing conference participants. Once the conference is established, no data goes through the designated site or a central host (56).

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Specification

METHOD FOR CREATING PEER-TO-PEER CONNECTIONS OVER AN INTERCONNECTED NETWORK TO FACILITATE CONFERENCING AMONG USERS

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention generally relates to methods for establishing network connections for conferencing over computer networks, and more particularly, a method for establishing conferences and linking conference participants to the conferences over the Internet.

Description of the Prior Art

In hosting a conference over a computer network such as the Internet, the conference host advertises and promotes the conference as to the subject matter of the conference and the time and location of the conference. Parties interested in participating in the conference join the conference via their network connections at the designated time.

The traditional paradigm of an on-line conference, referring to Fig. 1, consists of a host server 10 connecting a number of conference participants or clients 12a - 12c through their respective individual channels 14a - 14c. This is a client/server paradigm where a host server connects a number of clients. Under this paradigm, a great deal of computing resources are consumed by the host server.

The traditional paradigm is no longer adequate in meeting the dynamic and flexible environment demanded by the activity of the network users of today and of the future. Ideally, given the level of activity on the Internet, a different paradigm, referring to Fig. 2, is desirable. In this peer-to-peer paradigm, there is no host server, and a number of clients 18a-18e are connected via a number of channels 20a - 20e in a variety of manners. The advantage with this paradigm is that there is not a central host server to connect the clients. As long as the clients utilize application programs allowing communication across networks between the clients, this network paradigm is feasible and desirable.

However, there are several problems in establishing network connections over an interconnected network in accordance with the peer-to-peer paradigm. These problems prove to be cumbersome and sometimes are administratively impossible for the clients (or conference participants) to overcome. The problem lies in finding the Internet protocol ("IP") address of the client hosting the conference (conference chairperson) or the IP address of any one of the clients in the conference (conference participants).

An IP address uniquely identifies a user's Internet presence and is composed of four bytes of information representing a domain name and an identification number in that domain. By knowing the IP address of a user, an Internet connection can be established with that user.

However, the IP address of a particular user is not always the same. If a user dials into an Internet service provider ("ISP") in establishing an Internet connection, the users may be assigned a different IP address every time due to the fact that the ISP has a limited number of connections to the Internet and IP addresses must be dynamically allocated as requested. For users having direct connections

to the Internet through their company or organization, their IP addresses may be remapped, may change over time, or may be machine dependent. Furthermore, many companies and organizations have a computer network security barrier commonly referred to as a "firewall" to stop unauthorized intrusion into their computer networks, and the firewall may translate an IP address for a particular computer or user such that the computer or user is identified by a different address every time.

The problems with IP addresses minimize conferences from being established in accordance with the peer-to-peer paradigm on the Internet, minimizing activities such as document conferencing, video conferencing, etc.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a method for dynamically establishing a conference over the Internet in accordance with the peer-to-peer paradigm.

It is another object of the present invention to provide a method for maintaining the IP addresses of the conference participants of a conference for the purpose of allowing a new user to join a conference without having to know the IP addresses of the conference participants.

Briefly, a method for facilitating the creation and maintenance of network connections over an interconnected network for the purpose of facilitating the creation and participation of on-line conferences in accordance to the peer-to-peer paradigm is disclosed. A designated location on the network (e.g. a web site) on an interconnected network such as the Internet is setup in such a manner that a conference may be created and conference participants can be easily connected into the created conference by making a few simple selections. The IP addresses of the conference participants are maintained at the designated site and are transmitted to a new conference participant to allow the new conference participant to connect directly into the conference without the new participant having to know the IP addresses of the conference participants. The new participant may be connected to any one of the existing conference participants. Once the conference is established, no data goes through the designated site or a central host. Data packets are directly sent to and received by the respective application program of each participant.

An advantage of the present invention is that a conference participant may join a conference without having to know the IP addresses of other conference participants.

Another advantage of the present invention is that the established conference has no data going through a central host or a designated site.

These and other objects and advantage of the present invention will no doubt become obvious to those of ordinary skill in the art after having read the following detailed description of the preferred embodiments.

IN THE DRAWINGS

Fig. 1 illustrates connections in accordance to the client/server paradigm where users are connected to a central server for the purpose of conferencing.

Fig. 2 illustrates connections in accordance to the peer-to-peer paradigm where users are connected to each other without a central host.

Figs. 3-7 show web page layouts and hypertext selections in the preferred embodiment of the present invention.

Fig. 8 shows the basic architecture for web interface.

Fig. 9a is an overall design of the menu and command structure of the preferred embodiment.

Fig. 9b is a table of keys to Fig. 9a.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The preferred embodiment of the present invention provides a virtual conference hall on the World-Wide Web ("WWW") as a clearinghouse for all the conferences. A user, by using a web-browser and a helper-application program, may go to the virtual conference hall, announce and advertise a conference, create a conference, or join an on-going conference.

The host machine supporting the virtual conference hall does not actually host any conferences by receiving and redistributing data packets. Rather, the virtual conference hall facilitates the establishment of conference connections for users wishing to participate in a conference. Once a conference is established, data transmission from one user to another user is routed directly via the appropriate Internet protocol and transmission paths. For example, a user, by indicating the conference of his or her choice, is connected to the conference whereby an Internet connection is automatically established between this user and one of the existing conference participants without the user having to know the IP address of a conference participant.

Illustrating an example of the process of using an implementation of the present invention, a user by using a web browser goes to a designated site on the Internet such as "http:\\www.conferencehall.com." At this site, referring to Fig. 3, several selections are available to the user, administration 31, registration 33, general information 35, and lounge 37. Referring to Fig. 4, the administration selection provides the user with the option to create a conference 38, remove a conference 42, or have the user be the designated chairperson of a particular conference 40. If the user chooses to create a conference, referring to Fig. 5, the user is then provided with a form asking for information pertinent to the conference, information such as the conference title, host of the conference, subject of the conference, the user's name, the conference type, and an administrative password. When a conference is created, a conference record for this particular conference is created and inserted into a conference list containing the records for all the conferences. This list is automatically updated to reflect the conference as an on-going conference where people may freely participate in it if it is a public conference. Referring back to Fig. 4, under the administration page, a user may select to remove a conference (42) after the conference is over, provided that the user has the administrative password for the conference. An automatic conference removal method can also be implemented, as opposed to the manual removal process. As a third selection under the administration page, the user may select to change the chairperson of a conference (40), and the conference list will be updated to reflect such a change.

A user interested in becoming a conference participant, referring to Fig. 6, may register for a conference by selecting an ongoing conference from a list of on-going conferences. Referring to Fig. 7, if a conference is a public conference, the user joins the conference, and the user's name, IP address, and

other pertinent information is added to the conference record. Information regarding this conference is refreshed accordingly 58. In joining a conference, a helper application (or plug-in software) predefined in the pertinent section of the web browser is automatically launched and the user is connected to the selected conference through the helper application where the IP address of the conference chair or the conference participant(s) is automatically provided to the helper application to establish the Internet connection. Through the helper-application, the user becomes a conference participant and can begin discussions with other conference participants.

If the selected conference is a private conference, a password is requested before the user is allowed to join a conference. After finishing with a conference, a conference participant may remove his or her name from the conference list. The process for removing a conference participant from a conference list may be automated by periodically polling the status of the IP connection with the net browser or helper-application of the respective conference participants.

Having now described the process via one implementation of the present invention, the underlying techniques are now described. Fig. 8 illustrates the basic architecture for the World Wide Web interface for the preferred embodiment. The user 52 activates a web browser (also called net browser) 54 and connects to the Internet via the web browser. By visiting a site (web server 56) such as the virtual conference hall in our example "http:\\www.conferencehall.com", a file in the hypertext mark-up language (HTML) format is sent to the user and displayed by the web browser on the user's computer (remote computer). In certain cases, a form requesting information from the user is sent to the user in HTML format. By completing the form and sending it back to the web server (the host computer), a designated common gateway interface (CGI) script 58 (which is a series of commands in the PERL programming language) may be programmed to be executed by the web server. The commands in the script file may request the web server 56 to send a formatted Multi-Purpose Mail Extension (MIME) type stream to the user's web browser which may activate a particular helper application 60 to connect the user's helper-application to other conference participant's helper-applications 62.

Fig. 9a illustrates an overall menu and command structure (corresponding to Figs. 3-7) of an implementation of the preferred embodiment of the present invention and Fig. 9b provides a table of keys to the box symbols used in Fig. 9a. The menu and command structure are briefly described and the major functions such as the create-a-conference function and the join-a-conference function are described in detail in the following sections. When visiting the virtual conference hall on the Internet, the web server sends to the user the index.html file 70 which provides several hypertext selections. By clicking on a selection, the corresponding CGI script file may be executed and the corresponding HTML file is sent to the user 72-78.

From the administration HTML page 72, the user may select the start-a-conference selection 80 whereby the corresponding CGI script file is executed, a new conference record is created, and the conference list is updated. The user also may select to remove a conference. In this operation, the list of on-going conferences are displayed (84) to the user, the user selects a conference to remove, and, given the right password, the underlying remove-conference CGI script is executed (56) to remove the corresponding conference record. As a third selection under the administration page, the user may change

the chairperson of a conference by displaying the list of on-going conferences (88), and select and change the conference chair (90) of a particular conference. The corresponding CGI script updates the conference list.

Under the registration page 74, a user may join a public conference 94 whereby the user is asked to fill out a form and the user is added to the conference list 96. For a private conference, a password is requested from the user (98) before the user is allowed to join the conference (94). After finishing with a conference, the user may remove his or her name from the conference record 100.

The information page 76 may provide a variety of information regarding the conferences or any other type of information. The lounge page 78 may provide links to other sites for browsing while a user waits for other users.

Creating a Conference

In selecting the link to create a conference, a form is sent by the host server of the virtual conference hall to the user's web browser. The form provides blank spaces requesting conference information from the user, information such as the conference title, company name, subject of the conference, the user's name, an administrative password, and a password if it is a private conference. Once the form is filled out, the user clicks on a button on the screen which causes the form to be sent back to the host server. In receiving the form, the host server activates a conference creation CGI script that parses and extracts information from the form, and stores the extracted information as a new conference record into a conference list or database containing records of all the on-going conferences. Furthermore, the user's IP address is obtained from the CGI environment variable REMOTE_ADDR and stored in the conference record. Then, a MIME type stream containing information regarding the helper application that is to be launched by the user's browser and other pertinent information is sent back to the user's browser. The user's browser upon receiving the MIME stream launches the designated helper application, and the helper application is instructed to go into the listening mode to wait for incoming connection requests. The helper application in this case can be any conferencing software. In the preferred embodiment, the document conferencing software TalkShow is used. With the helper application in listening mode, one or more subsequent connections will establish a conference where users are connected and may chat or pull up documents or graphs for discussion and annotation via their helper applications.

Joining a Conference

For a user to participate in a conference, the user clicks on the Conference Registration icon which will cause the conference list to be displayed to the user. By clicking on the conference of his or her choice, a form is sent to user requesting the user's name and a password if it is a private conference. When the user sends the form back to the host server, a join-conference CGI script is executed where the information provided by the user is extracted and stored in the corresponding conference record in the conference list. This user's IP address is stored as well for later use. Then, a MIME stream containing the IP address of the conference chair along with other pertinent information is sent back to the user. Upon receiving this MIME stream, the user's web browser activates the same or a compatible helper-application,

and the IP address of the conference chair is provided to the helper-application. The helper-applicati n makes a TCP/IP call to the conference chair using the given IP address. Upon receiving the call, the chairperson's helper-application connects to the caller and a conference session is thereby established.

Once the conference session is established, there is no traffic (data packets) going through the conference hall server machine (the host computer). The conference participants communicate directly to each other via their helper-applications.

In the case where the connection for the conference chair is dropped and its IP address is no longer active, another conference participant may become the conference chair by going back to the virtual conference hall and updating the conference list via the "change chairperson" selection. This conference participant then becomes the chairperson and its IP address is stored accordingly.

In an alternate embodiment, if the conference chairperson's connection is dropped and a new conference chair is not designated, a new conference participant may join the conference by using the IP address of any one of the current conference participants. This embodiment can be implemented by sending the IP addresses of all the current conference participants in the MIME stream to the user's browser and have the helper application be directed to try all the addresses until an active address is found.

Removing a Conference Participant

A conference participant may leave the conference and manually sign off the conference via a provided selection on the registration page of the virtual conference hall so that the user's name will not be shown as a conference participant. The user's name will be deleted from the conference record by a CGI script. This process can also be automated where the server of the virtual conference hall periodically samples the connections to determine existing conference participants and updates the conference record accordingly.

Note that in the case where a network has a firewall and there is a SOCKS proxy running between the browser and the web server, the CGI script gets the IP address of the SOCKS proxy rather than the IP address of the client machine that is running the browser. This problem is solved by providing a name registration daemon that registers each participant's IP address and port number. When the helper-application is launched by the browser, the helper-application first makes a TCP/IP connection to the daemon so that the daemon registers the helper-applicant's client's IP address.

Although the present invention has been described in terms of the presently preferred embodiment, it is to be understood that such disclosure is not to be interpreted as limiting. Various alterations and modifications will no doubt become apparent to those skilled in the art after reading the above disclosure. Accordingly, it is intended that the appended claims be interpreted as covering all alterations and modifications as fall within the true spirit and scope of the invention.

What I claim is:

CLAIMS

1. A method for establishing peer-to-peer network connections over an interconnected network for two or more users, comprising the steps of:

a) receiving by a host computer connection information of a first user using a first remote computer having a first network address, said connection information including said first network address of said first remote computer;

b) storing on said host computer said connection information of said first user;

c) receiving by said host computer connection information of a second user using a second remote computer having a second network address, said connection information of said second user including said second network address of said second remote computer;

d) storing on said host computer said connection information of said second user; and

e) sending by said host computer said connection information of said first user to said second remote computer, said second remote computer using said connection information of said first user establishing a direct network connection to said first remote computer.

2. A method of claim 1 further including the steps of:

f) receiving by said host computer connection information of a third user using a third remote computer having a third network address, said connection information of said third user including said second network address of said third remote computer;

g) storing on said host computer said connection information of said third user; and

h) passing said connection information of said first user to said third remote computer, said third remote computer using said connection information of said first user establishing a direct network connection to said first remote computer.

3. A method of claim 1 further including the steps of:

f) receiving by said host computer connection information of a third user using a third remote computer having a third network address, said connection information of said third user including said second network address of said third remote computer;

g) storing on said host computer said connection information of said third user; and

h) remote computer using said connection information of said second user establishing a direct network connection to said second remote computer.

4. A method as recited in claim 1 wherein said connection information of said first user further includes a conference title and a host name.

5. A method as recited in claim 1 wherein said direct network connection for a particular user is terminated by the steps of:

sending by the remote computer of said particular user a request for termination of said direct network connection of said particular user;

receiving by said host computer of said request; and

deleting said connection information of said particular user from said host computer.

6. A method for establishing peer-to-peer network conferencing connections over the Internet for two or more users, comprising the steps of:

a) receiving by a host computer the connection information of a first user using a first remote computer having a first Internet-protocol address for establishing a conference over the Internet, the connection information including said Internet-protocol address of said first remote computer, and conference information;

b) storing on said host computer the connection information of said first user;

c) receiving by said host computer the connection information of a second user using a second remote computer having a second Internet-protocol address, the connection information of said second user including said second Internet-protocol address of said second remote computer;

d) storing on said host computer the connection information of said second user; and

e) passing the connection information of said first user to said second remote computer, said second remote computer using the connection information of said first user establishing a direct network connection to said first remote computer.

7. A method of claim 6 further including the steps of:

f) receiving by said host computer connection information of a third user using a third remote computer having a third network address, said connection information of said third user including said second network address of said third remote computer;

g) storing on said host computer said connection information of said third user; and

h) passing said connection information of said first user to said third remote computer, said third remote computer using said connection information of said first user establishing a direct network connection to said first remote computer.

8. A method of claim 6 further including the steps of:

f) receiving by said host computer connection information of a third user using a third remote computer having a third network address, said connection information of said third user including said second network address of said third remote computer;

g) storing on said host computer said connection information of said third user; and

h) passing said connection information of said second user to said third remote computer, said third remote computer using said connection information of said second user establishing a direct network connection to said second remote computer.

9. A method as recited in claim 6 wherein said conference information includes a conference title and a host name.

10. A method as recited in claim 6 wherein said direct network connection for a particular user is terminated by the steps of:

sending by the remote computer of said particular user a request indicating termination of the direct network connection of said particular user;

receiving by said host computer of said request; and

deleting the connection information of said particular user from said host computer.

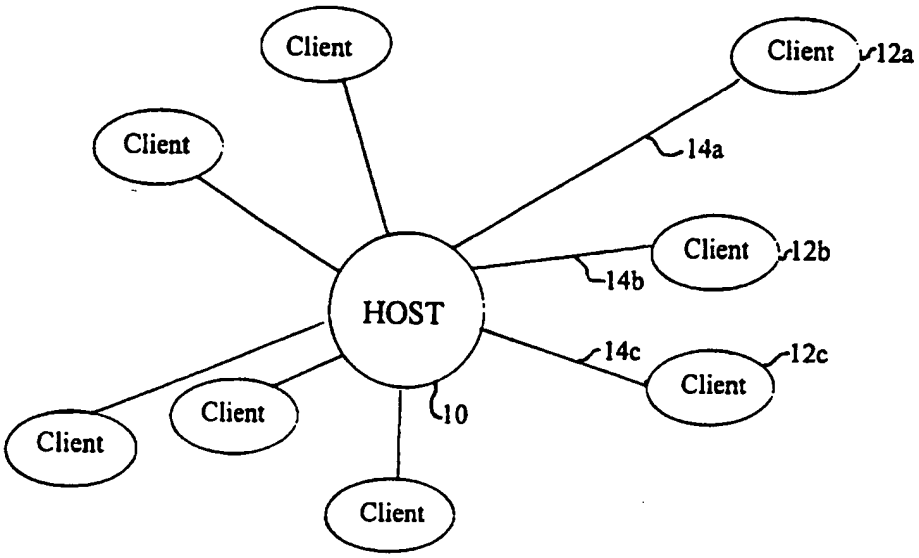

Client
Client
Client
12a
14a
Client
12b
14b
HOST
14c
Client
12c
Client
Client
10
Client

Fig. 1

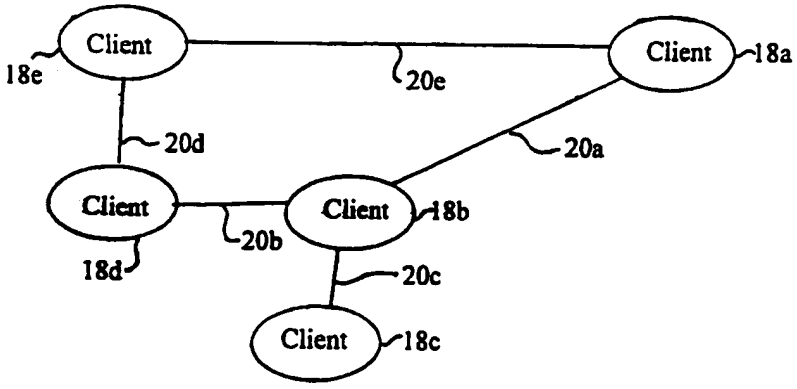

Client
18e
20e
Client
18a
20d
20a
Client
Client
18b
20b
18d
20c
Client
18c

Fig. 2

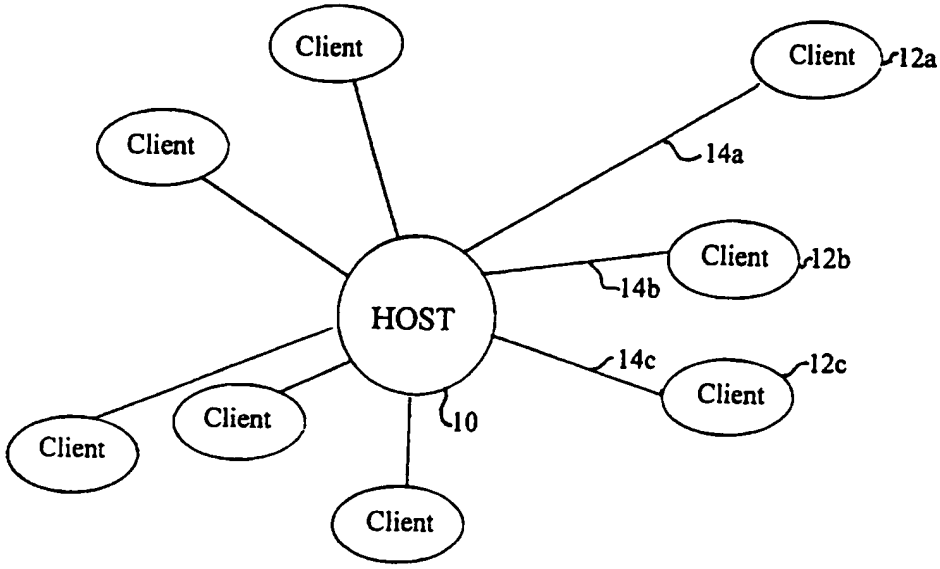

Client
Client
Client
12a
14a
Client
12b
14b
HOST
14c
Client
12c
Client
Client
10
Client

Fig. 1

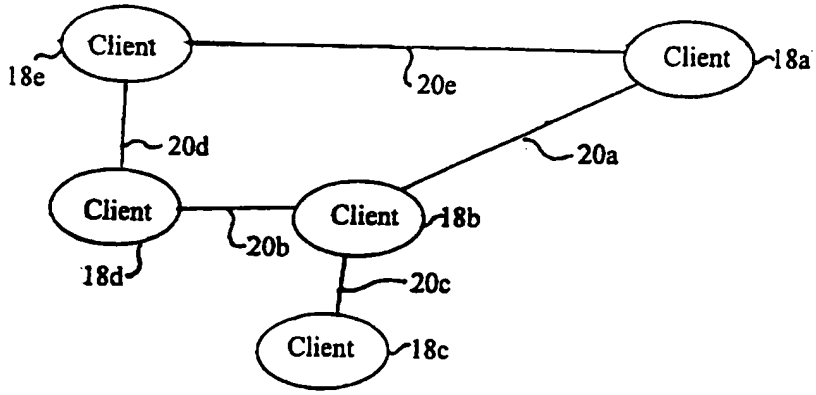

Client
18e
20e
Client
18a
20d
20a
Client
Client
18b
20b
18d
20c
Client
18c

Fig. 2

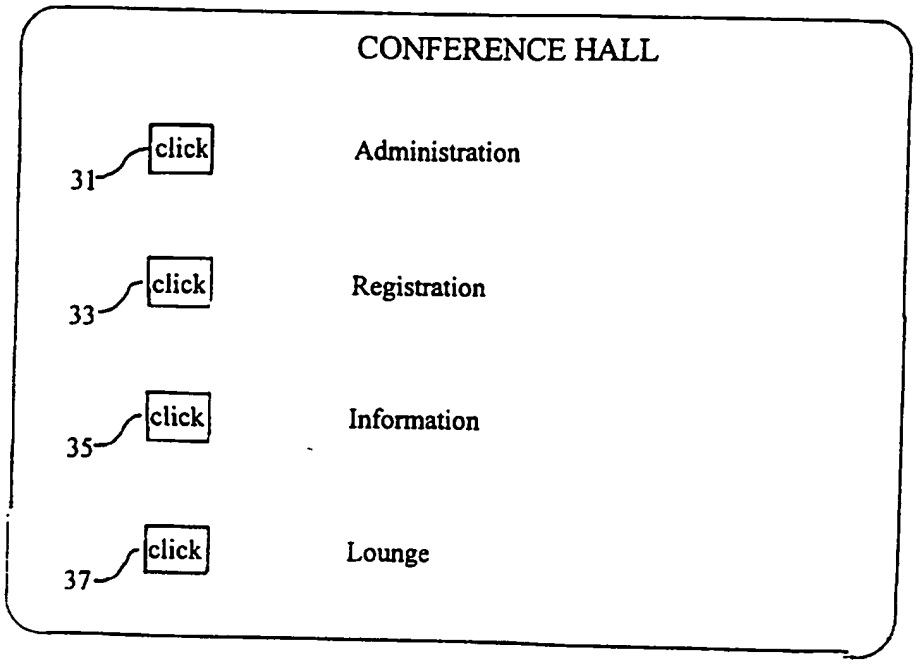

CONFERENCE HALL
31
click
Administration
33
click
Registration
35
click
Information
37
click
Lounge

Fig. 3

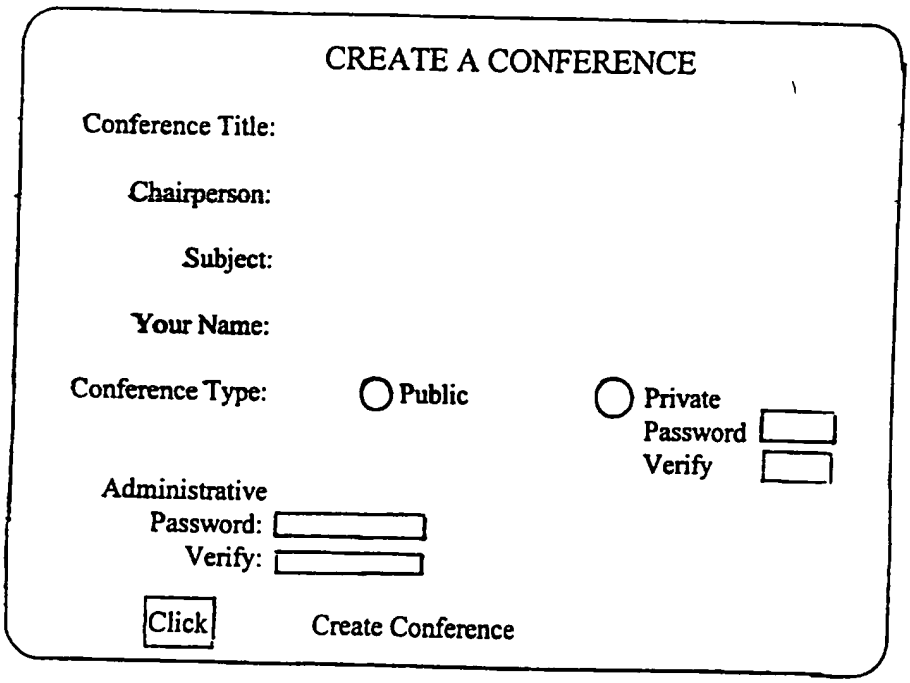

CREATE A CONFERENCE
Conference Title:
Chairperson:
Subject:
Your Name:
Conference Type:
Public
Private
Password
Verify
Administrative
Password:
Verify:
Click
Create Conference

Fig. 5

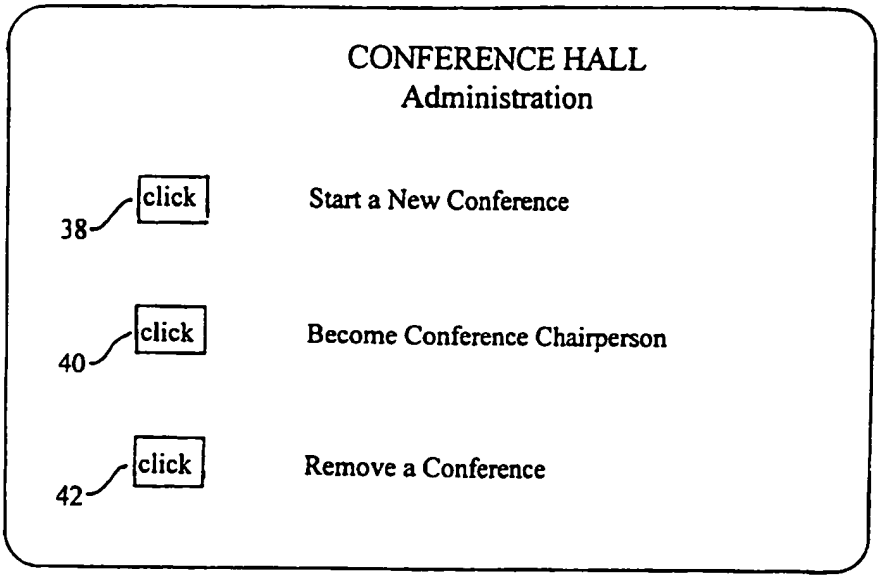

CONFERENCE HALL
Administration
38
click
Start a New Conference
40
click
Become Conference Chairperson
42
click
Remove a Conference

Fig. 4

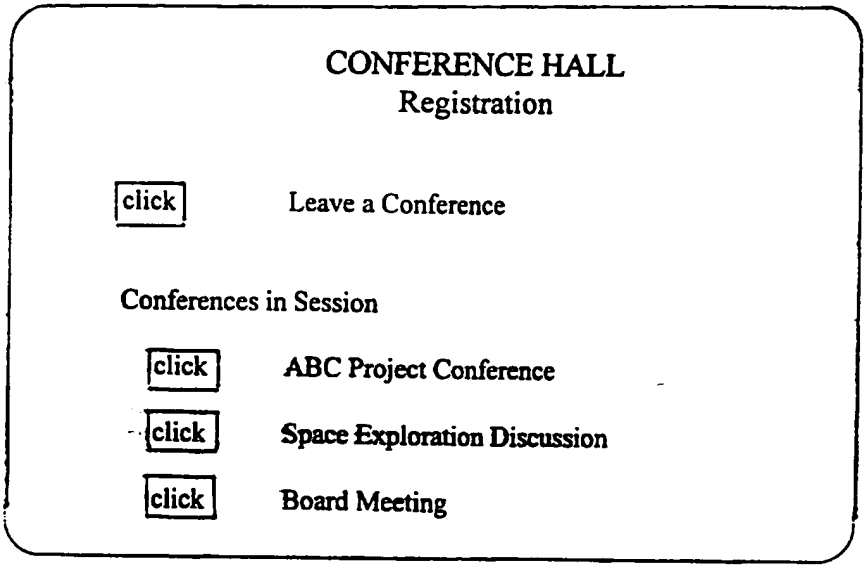

CONFERENCE HALL
Registration
click
Leave a Conference
Conferences in Session
click
ABC Project Conference
click
Space Exploration Discussion
click
Board Meeting

Fig. 6

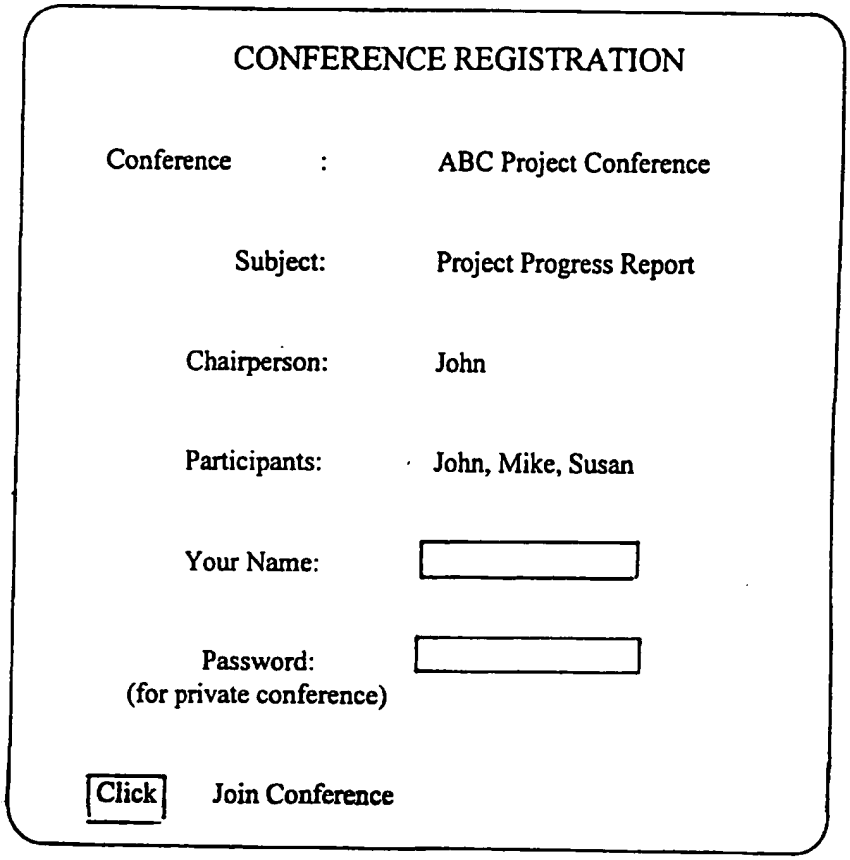

CONFERENCE REGISTRATION
Conference : ABC Project Conference
Subject: Project Progress Report
Chairperson: John
Participants: John, Mike, Susan
Your Name:
Password:
(for private conference)
Click
Join Conference

Fig. 7

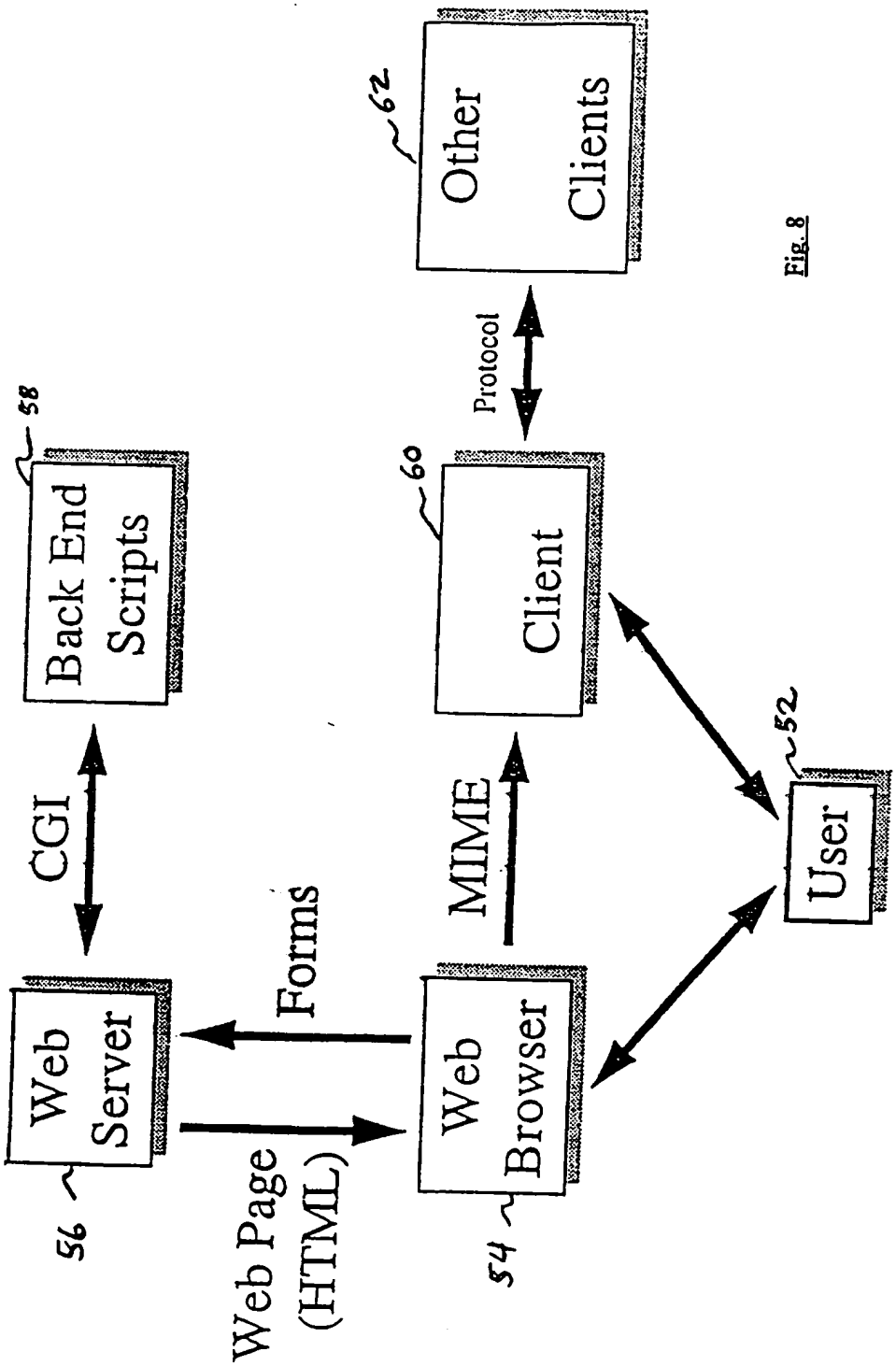
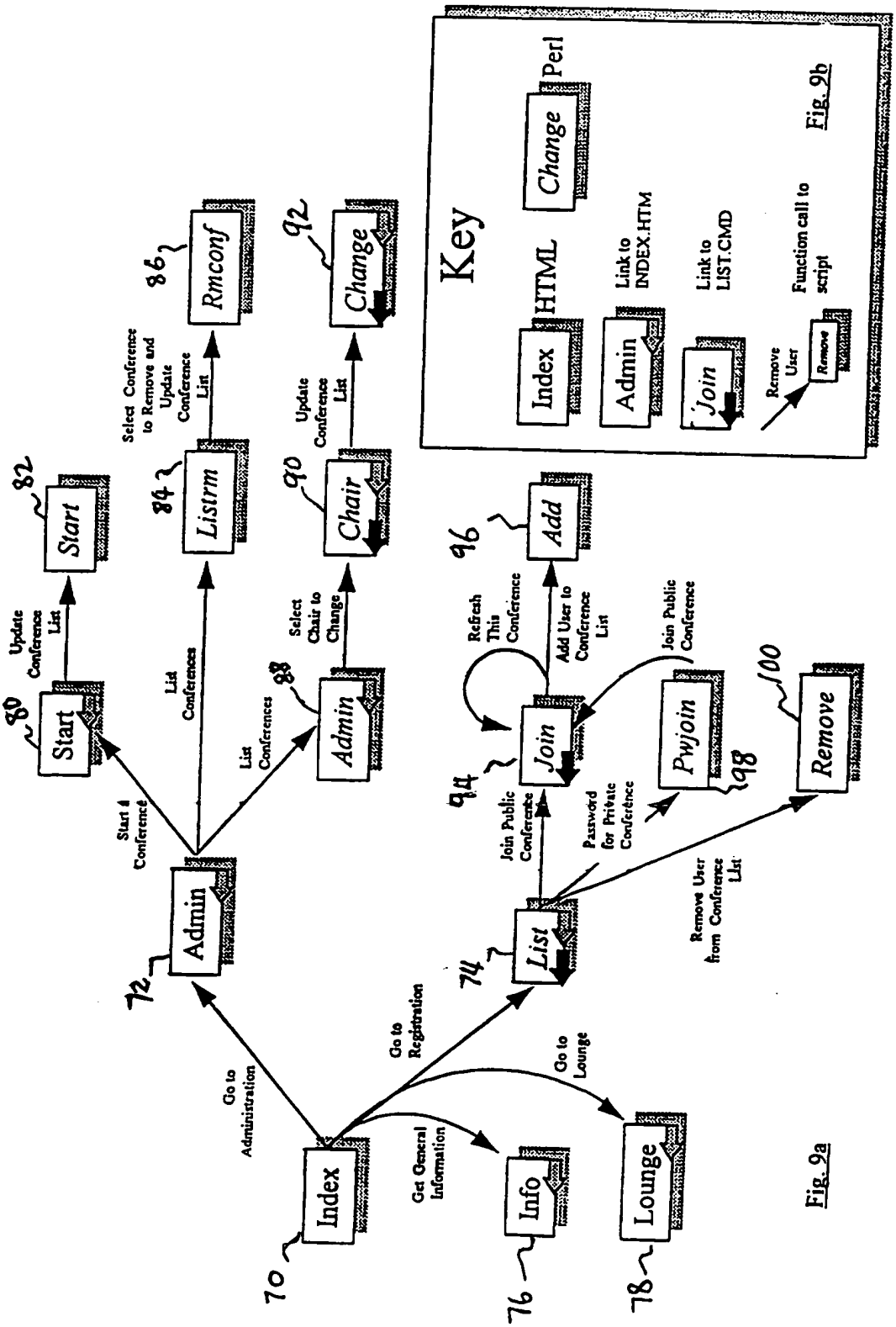

Other Clients
62
Protocol
Back End Scripts
58
Client
60
CGI
MIME
User
52
Forms
Web Server
Web Browser
Web Page (HTML)
56
54

Fig. 8


Key
Perl
Change
HTML
Index
Link to INDEX.HTM
Admin
Link to LIST.CMD
Join
Function call to script
Remove User
Remove
Index
Info
Lounge
Admin
List
Join
Pwjoin
Remove
Start
Listrm
Rmconf
Chair
Change
Add
Start
Admin
Go to Administration
Get General Information
Go to Registration
Go to Lounge
Start a Conference
Update Conference List
List Conferences
Select Conference to Remove and Update Conference List
Select Chair to Change
Update Conference List
Join Public Conference
Password for Private Conference
Remove User from Conference List
Refresh This Conference
Add User to Conference List
Join Public Conference
70
72
74
76
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80
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84
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92
94
96
98
100

Fig. 9b

Fig. 9a

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/03099

A. CLASSIFICATION OF SUBJECT MATTER
IPC(6) :G06F 13/00
US CL :395/200.09
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 395/200.09

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
IEEE Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, 5,475,819, A (MILLER ET AL.) 12 December 1995, col. 2, co.4, col. 6-7.	1-10
Y	Wise et al., IEEE publication, 1993, "Message-Brokers: A Novel Interprocess Communications Primitive, pages 184-193, especially 186.	1-10
A,P	US, 5,572,643, A (JUDSON) 05 November 1996, the whole reference.	1-10
A,P	US, 5,546,584, A (LUNDIN ET AL.) 13 August 1996, the whole reference.	1-10

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be part of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 03 APRIL 1997	Date of mailing of the international search report 05 MAY 1997
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ZARNI MAUNG Telephone No. (703) 305-3900

Form PCT/ISA/210 (second sheet)(July 1992)*